

NEW BEES AND WASPS—PART IX

Four Undescribed species of *Exoneura*, with Notes on Their Collection, and Description of New Parasites Discovered on the Genus.

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Introductory

My collaborator in the field, Norman Rodd of Lane Cove, Sydney, has been singularly successful in collecting the twig "nests", eggs, larvae, pupae and adults of many *Exoneuras*, and his conscientious work has greatly extended our knowledge of the rise of a social state in the insect world.

The *Exoneuræ* have only one communal chamber for the entire brood. This utter lack of individual cells in the nursery is both surprising and unique, not only in the *Apidae*, but also in the whole Order *Hymenoptera*, for in no other genus is there a complete absence of cell-walls.

The absence of cell divisions is much more significant than appears at first glance, for it connotes there are no walls to be demolished, no cell-caps to be pierced, before the young adult can emerge to liberty.

The *Euryglossa*, burrowing in hard ground, sets its young the formidable task of tearing down the hard earthen plug that seals its burrow. The young of *Megachile*, the "leaf-cutter bee," has to saw through a barrier of dry leaves, and sometimes a plug of resin, as well as a tough silken cocoon, before it is free. The progeny of the beautiful blue-banded bees, *Anthophora*, find themselves confronted with a wall of concrete, which must be pierced before they can reach the sunshine.

The young of *Exoneura*, on the other hand, faces no such formidable task on emerging from its natal cradle. They are small, soft bees, incapable, one would conclude, of any arduous effort. They are not even required to cut a way out of a tough brown silky cradle, like so many other honey-gatherers, for there is no silken or papery cocoon. The young bee has merely to walk out, unfettered and unhindered.

The three methods of feeding, too, show a gradual approach to the complex feeding habit of the hive-bee. In certain species the larvae each receive an individual pudding of honey and pollen; the second group provides a communal cake for all the babies; and the third division appears to carry the progressive feeding of predigested "pap" to some length. All these traits are undoubtedly steps in the evolution of the social state, which is seen *in excelsis* in the honey-bee.

The adults, too, depart from a basic law of all solitary bees. No solitary wild bee mother will permit a stranger to roam among

her precious puddings and brood, although the males of solitary bees (*Paracolletes*, for example) often cluster in hundreds to pass the night together in mutual comfort. However, on many occasions, Rodd has taken "tubes" containing eggs, larvae and several females. These specimens puzzled me, until I subsequently satisfied myself that at least three distinct species were present.

It is now definitely established, as a result of Rodd's work, that the females of *Exoneura* will tolerate—perhaps invite and enjoy—the company of females of other species, even though brood in all stages be present.

A singular example was obtained at Brooklyn, on the Hawkesbury River, New South Wales, in February, 1947. A lantana stem was found to contain two robust *E. excavata* Ckll., two equally robust *E. montana* Raym., and one female of the much smaller *E. sub-holmesii* Raym. There was no doubt that the three distinct species were living amicably together. It may be only a case of sheltering from inclement weather, yet such hospitality is quite unknown among solitary wild-bees and, indeed, even the social species, for the honey-bee will attack instantly a tiny *Trigona* that endeavours to enter her hive. Nay, more, she will immediately engage in a death duel with any strange worker of her own species from a hive in close proximity to her own.

NEW SPECIES

There are several new species among the bees taken by Norman Rodd, and specific descriptions of these are appended.

Exoneura apposita, sp. nov.

TYPE. Male—length 5 mm. approx. Black and red.

Head transverse, black and shining; lateral face-marks white, reaching a trifle higher than the clypeus; frons rising to a high carina; a basin about the median ocellus; clypeus entirely white; supra-clypeal area black; vertex with a few fulvous hairs; compound eyes black, large, but converging below; genae with a few white hairs; labrum white; mandibulae white, with black tips; antennae with scapes white in front, flagellum brownish beneath.

Prothorax with a few long white hairs; tubercles black; *mesothorax*, scutellum and postscutellum black, shining, with a delicate tessellation, and a few white hairs; *metathorax* with a number of white hairs laterally, and these become denser on the pleurae; abdominal dorsal segments light-ferruginous, each with a wide band of black; ventral segments a clear ferruginous.

Legs ferruginous, the coxae, trochanters and hind tibiae black, with much black hair; tarsi red, except the hind, which are black with black hair; claws dark-reddish; hind calcar blackish; tegulae piceous (light-amber in *E. angaphorella*).

Wings yellowish; nervures dark-amber; cells: second cubital very wide, pterostigma large and brown, hamuli five or so very weak.

The allotype female looks very like *E. angophorella* Raym., but the clypeal mark on the new species is clearly defined as a yellow "T" with the cross-arms hooked, and the base thickened; there is a lateral yellow patch on the orbital margins; the front of the scape is ferruginous, and the labrum dark-red; there is an amber spot on the mandibles.

Locality: Lane Cove, New South Wales, leg. Norman W. Rodd, January, 1947 (TYPE and ALLOTYPE in the collection of the author).

A series of males and females, together with many eggs, larvae and pupae in all stages, were taken from a stem of lantana.

Allies: Except for the well-defined face-marks, I do not know how the female can be separated from *E. angophorella* Raym., but the male is close to *E. hackeri* Ckll., which has black scapes, and also to *E. clarissima* Ckll., which has the second segment of the flagellum white. By the larval appendages this species approaches *E. similima* Raym. There is a small node, the largest appendage quadri-dactylous having two long "fingers" and two short "fingers". The other segments bear short nodes, the three posterior ones being the longest. The processes of the head are inconspicuous.

Exoneura concava, sp. nov.

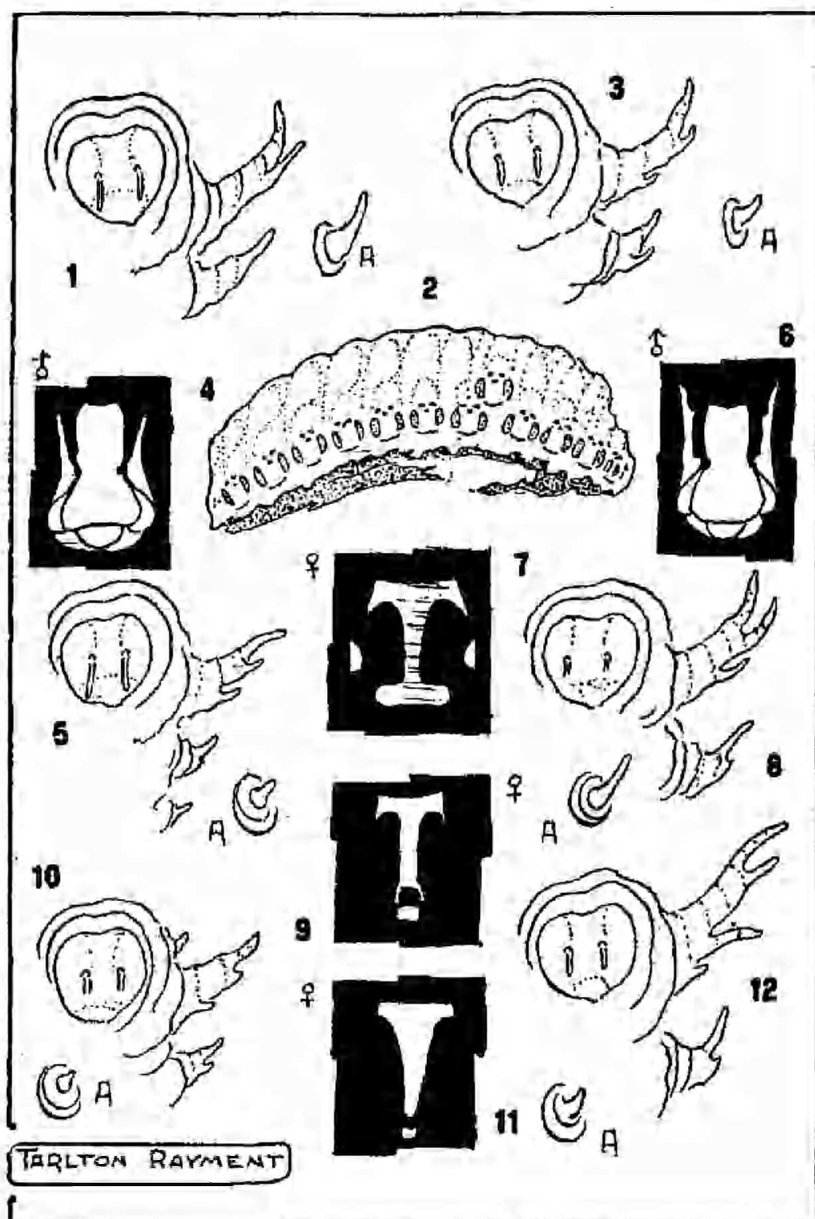
TYPE: Male—length 5 mm. approx. Black, dark-red abdomen.

Head transverse; face quite basin-like, and polished; frons shining; clypeus obscurely suffused with reddish; supra-clypeal area the merest microscopical node; vertex shining, broad; compound eyes, large, converging slightly below; labrum obscurely reddish; mandibulae black, reddish apically; antennae black, flagellum obscurely reddish below.

Prothorax not visible from above; tubercles black, with a fringe of white hair; *mesothorax* glistening, but still showing a delicate sculpture, and an odd large puncture; scutellum and postscutellum similar; *metathorax* large, with a distinct tessellation, a few long white hairs which extend to the pleura; abdominal dorsal segments are suffused with blackish, except the hind margins and the apical two; ventral segments only slightly suffused, each with a scanty fringe of yellow hair.

Legs red, more or less suffused with black, but hair is reddish-copper, except on hind tibiae, where there is some black; tarsi red; claws red; hind calcar red; tegulae piceous.

Wings dusky; nervures brownish; cells: the second cubital almost an equilateral triangle, pterostigma dark-brown, hamuli weak.



1. Larval appendages of *Exoneura concava*, sp. nov. 2. Larva of *Exoneura*, probably *sub-holmesii* Raym., heavily parasitized by a minute wasp (dorsal view). 3. Larval appendages of *Exoneura roddi*, sp. nov. 4. Clypeal mark of male *E. variabilis*, sp. nov. 5. Larval appendages of *E. montana* Raym. 6. Clypeal mark of male *E. apposita*, sp. nov. 7. Clypeal mark of female *E. apposita*. 8. Larval appendages of *E. variabilis*. 9. Clypeal mark of female *E. sub-baculifera* Raym. 10. Larval appendages of *E. excavata* Ckll. 11. Clypeal mark of female *E. marjoriella*, sp. nov. 12. Larval appendages of *E. apposita*.

Locality: Brooklyn, New South Wales, *leg.* Norman W. Rodd, February 2, 1947 (TYPE in the collection of the author).

Two females were taken from a stem of lantana, together with three pupae and five larvae, all in a fat, healthy condition.

The first larval appendage is di-dactylous, and the second simple and slender. The other abdominal appendages are long and slender, but segments 5, 6, 7, 8 have only vestigial nodes; the longest are the caudal ones, as in *E. albolineata* variety (see *Vict. Nat.*, Aug. 1948, p. 88, fig. 2). There is some relationship by the appendages to *E. sub-baculifera* Rayn.

Exoneura marjoriella, sp. nov.

TYPE: Male—length 9 mm. approx. Black, red abdomen.

Head transverse, frons rising to a fine carina, finely punctured; clypeus coarsely but distinctly punctured, with a dark-amber mark like a tack with an excessively thick stem (see Fig. 11, page 250); supra-clypeal area high, and distinctly punctured; vertex with a few black hairs; compound eyes with anterior margins parallel; genae prominent; labrum obscure red; mandibulae black, obscure reddish apically; antennae with flagellum reddish beneath, a red line on scapes.

Prothorax not visible from above; tubercles black, with a white fringe and a few long plumose golden hairs; *mesothorax* shining, but a microscopic tessellation, and a few blackish hairs on the anterior "corners", a few large punctures; scutellum and post-scutellum similar; *metathorax* large, with a tessellate sculpture and some golden hair laterally, which extends to the pleura; abdominal dorsal segments a rich dark-chestnut red, with a thick black "I" on one, and a black patch on two; the apex of the abdomen is darker, with considerable black hair; ventral segments red, each with a short fringe of golden hair.

Legs chestnut-red, coxae and trochanters and extreme base of femora black, hind tibiae with much black hair, otherwise legs have golden hair; tarsi red; claws red; hind calcar red; tegulae black.

Wings dusky; nervures brownish; cells: second cubital very long, pterostigma blackish, hamuli six or so, weak.

Locality: Brooklyn, New South Wales, *leg.* Norman W. Rodd, January, 1947 (TYPE in the collection of the author).

The larvae were taken from stems of lantana, and the appendages reveal a close relationship to *E. hamulata*, for the first is tri-dactylous and the third simple, the "fingers" being very short and stout on all. The other abdominal segments bear only very short nodes.

Allies: Clearly approaches *E. hamulata* Ckll., which has hooked cross-arms on the narrower clypeal mark.

The species is dedicated to Marjorie Rodd, Lane Cove.

Exoneura variabilis, sp. nov.

A "nest" series of adult males and females, eggs, larvae and pupae demonstrate how very necessary it is to have all these stages for study before describing a new species. In the absence of larvae some of the females of this undescribed species would certainly be determined variously as *E. angophorae*, *apposita*, *angophoralla*, *holmesi*, *obliterata*, and even as other species not so closely related.

The lateral face-marks of these females may be the merest trifling yellow dots; the whole clypeus obscurely suffused with reddish; the base only of the clypeus dark-amber. The entire "face" may be entirely black, as in *E. froggattii*.

Each of the ferruginous abdominal segments bears a band of suffused black, and the hind legs of both males and females have much black hair as in *E. angophorae* Ckll.

The clypeus of the male is white, and this, together with two large lateral marks, makes the "face" almost indistinguishable from that of *apposita*, and only a little different from *hackeri*; which has triangular lateral marks.

The larval appendages, however, at once separate this species from the others named above, for the large appendage is tri-dactylous. The cephalic processes are exceedingly short, and the abdominal nodes long, the three caudal ones being the most conspicuous.

Locality: Narooma, New South Wales, leg. Norman W. Rodd, December, 1946 (PARATYPES in the collection of the author).

In the stem of a "reedy grass or sedge."

FURTHER NOTES ON TWO SPECIES OF EXONEURA

Exoneura montana Rayment

A series of fine robust females—they measure 10 mm. in length—was taken by Norman Rodd from galleries in stems of *lantana* at Brooklyn, N.S.W. These are the largest borings the author has ever recorded for this genus, since they measure $7\frac{1}{2}$ cm. in length, with a diameter of 4.5 mm., and are excavated in the dry pithy interior of stems 15 mm. thick.

The white plump larvae are fully 8 mm. approx. in length, and possess only one tri-dactylous appendage, the second having a tiny basal node. The other segments have only short nodes, but the two processes of the head are very long. In its larvae this species approaches *E. hamulata* Ckll.

Exoneura excavata Ckll.

Another series of large robust typical females was taken at the same time as the above, in similar plant stems.

The first larval appendage is reduced to a mere node; the large second one is tri-dactylous, but the "fingers" are shorter and

stouter than on *E. concava* Raym. The other abdominal nodes are exceedingly short, as are the head processes.

REMARKABLE INTERNAL PARASITE

Norman Rodd, in February, 1947, collecting at Brooklyn on the Hawkesbury River, New South Wales, opened a series (about 30) of dry plant-stems of lantana containing *Exoneura* galleries. In one were seven rather hard, dry mummies of what appeared to be larvae of *E. sub-holmesei* Raym.

Under the microscope, the author was able to discern that each body was regularly and closely packed with pupae of some small hymenopteron—a parasitic wasp.

All the pupae were lying in a transverse position, with their heads aligned along the left side in dorsal view. The compound eyes and the minute ocelli appeared as purple patches, separated in twos by three minute triangles of purple dots. These presented a singularly uniform arrangement when the bee-larva was viewed laterally.

When the body was turned over, the other side resembled a microscopic delicate mosaic pavement, although it was actually formed of minute excremental pellets voided by the parasites immediately prior to their entering the pupal stage, and just after the junction of the mesenteron and the proctodeum. Three days later, the crystal-white larvae had become quite black, and the pigmentation was complete.

Seven larvae of the *Exoneura* had been parasitized, and the young wasps emerged on February 15, 1947. Each larval body contained 24 parasites, which connotes that the *Chalcid* mother is aware of the exact quantity of food required to bring her progeny to maturity, for only the dry skin of the bee-larva remains after having served as a communal cocoon. The grand total of wasps that emerged was 168.

Family ENCYRTIDÆ

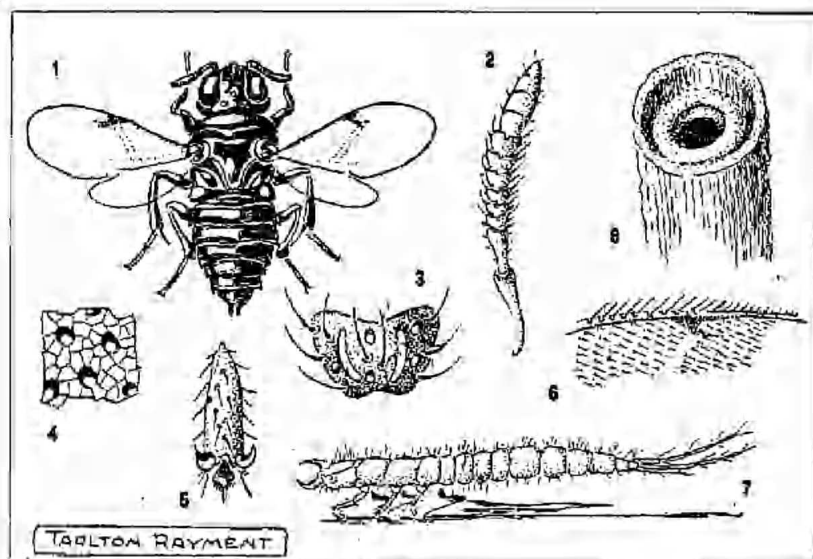
Aphycus asperithorax, sp. nov.

Chalcids black, 1.5 mm. in length, with a width of .45 mm. *Head* hemi-spherical from above, the vertex broadly rounded, with an obscure bluish-purple lustre, coarsely and closely punctured on a microscopic tessellate sculpture; compound eyes large, bright claret in colour, and claret ocelli widely spaced; mandibles black; flagellum .25 mm. long, the segments becoming very thick apically, and each with parallel conspicuous white organs, the basal segment of the flagellum longest; scape short and slender.

Pronotum well developed; *mesothorax* small, with the sculpture of the head; scutellum very large, and of similar sculpture; *meta-thorax* exceedingly stout; abdomen sessile; gaster amber-coloured.

Legs black, but the coxae and trochanters show bluish lustre; tarsi cream-coloured, with the apical segment suffused with blackish coloration; median tibiae are 4 mm. in length, and the conspicuous calcar is 1.75 mm. long.

Wings large, covered thickly with short hairs, neuration vestigial.



1. Adult wasp, *Aphycus asperithorax*, sp. nov.
2. Antenna of same, enlarged.
3. A segment of the flagellum highly magnified to show the parallel white organs.
4. Sculpture of the mesothorax and scutellum.
5. Fifth tarsal segment of the wasp.
6. Costal margin of the wing.
7. Coleopterous (?) larva found in the "nest" of an *Exoneura*.
8. When the tube is too wide, the *Exoneura* reduce the diameter by a ring of wood pulp at the entrance of the "nest".

The wasp is a typical micro-chalcid, and Tillyard says that the strong median tibiae of the Family *Encyrtidae* are formed for jumping; but these wasps did not show any trace of that habit, although they are able to run quickly.

ACARID MITES

I have several *Exoneura* females heavily infested with amber-coloured Acarid mites, which are widely distributed over the body, along the legs, and even over the wings. Rodd also found the larvae of some coleopteron devouring larvae in the "nest" of an *Exoneura*.